HISTOLOGICAL AND MICROMETRICAL CRITERION FOR PULMONARY IMMATURITY AND ITS SIGNIFICANCE IN STUDYING THE PERINATAL PATHOLOGY

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Certain importance for creation and development of respiratory disorders in new-born is attributed to non-infectious pneumopathies based on pulmonary immaturity (PI)), as it is suggested by some authors (1, 2, 6, 9, 11, 12). The most serious cause for lethality in perinatal period, according to Byerre and Ostberg is the immaturity itself, clinically manifested with asphyxia, whereas pathoanatomically — with pulmonary immaturity (PI). However, until now there was not a precise criterion, based on any simple and easy method to determine the PI when investigating necropsy materials (13). Therefore, analysing the lethal cause of perinatal cases PI was not usually considered as a possible reason for development of respiratory disorders.

Having in mind bibliographical data and our own experience in studying the pulmonary pathology of new-borns we have for an object of our present work to find out and investigate simple and practical morphological criteria for evaluation of PI. Based on all that we will try to determine the frequency of PI among autopsy materials: still-born and new-born lethal cases, thus analysing the most often pathological processes in the lungs of dead foetuses with PI.

Materials and methods

Lungs of 308 dead foetuses autopsized in the Department of Pathoanatomy, Higher Institute of Medicine, Varna city, were thoroughly investigated. They were divided intro: 55 still-born and 253 new-borns; the latter were subdivided into 108 mature and 145 immature born foetuses. The representative group of 30 babies (15 born 1—2 months before the terminal pregnancy period, weight 900—1200 g and the rest 15 — normally born, weight over 3000 g) was specially studied by using linear micrometering and method of free sets. The histological preparations were worked after the parafin-method, stained by haematoxilin-eosin (HE), silver impregnation after Gomory, AZAN, Resorcin-fuxin after Weigert, PAS-reaction, staining with primulin and acriflavin for a luminiscent establishment of collagen and elastic fibres.

Results and discussion

The lungs of premature-born foetuses and those with a low weight were averagely about 300 microns in size. Alveolar cells in airy spaces were 15—25 microns, oval form, central nucleus, rich bright cytoplasma with certain amount of glycogen. The capillary set was well developed; final capillary branches were between epithelial cells, very near to the airy spaces. The high

cubic epithelium provided a characteristic glandule-like appearance of the airy spaces (fig. 1). Alveolar septums were considerably thicker, fine and lightly stained with HE when compared to the narrow and tender connective-

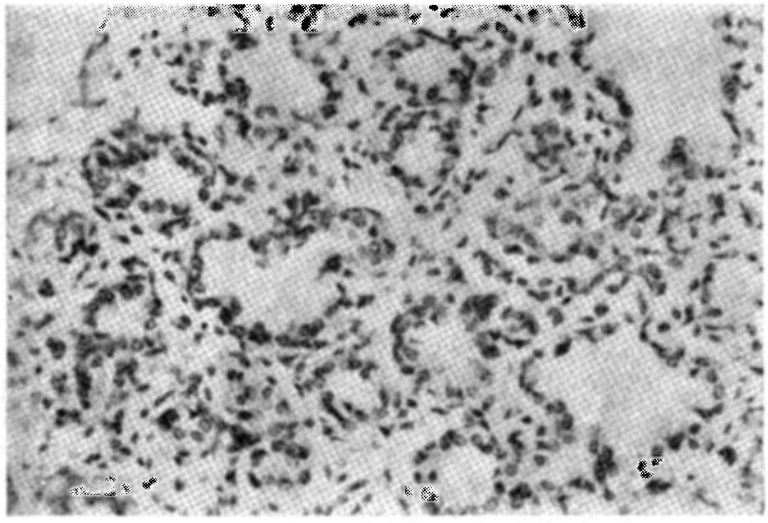

Fig. 1

tissue alveolar septums of normally born, with normal weight, babies. The alveolar septums of immature born foetuses were built of fibroblasts with linghtly stained nuclei and excess intercellurar substance where PAS-positive masses and fine argirofile fibres could be detected.

The intersegmental and interglobular mesenchyme tissue was represented by wide stripes with thickness up to 600—700 microns (fig. 2). It looked like as if losen, swelled, consisting of a few only fibroblasts and tender reticular fibres. Under the luminiscent microscope were established fine collagen fibres. The separate pulmonary segments and lobes (lobules) were well outlined by an excess of immature connective tissue. The visceral pleura is thickened, losen and full of intercellular substance.

Characteristic changes were established in blood vessels too. They were with thicker walls and excess immature connective tissue in perivascullar spaces.

Having in mind all aforementioned we could conclude that immature-born babies had a very characteristic feature of their lungs: prevailing of mesenchyme components (thick alveolar septums, excess interacynosical and intersegmental connective tissue, excess immature connective tissue in perivascular spaces) as a compensation of the smaller airy spaces and rarer taping epithelium. This peculiarity could be demonstrated by morphometrical study by using the method of the free sets.

The cited morphological features undoubtfully can be used as certain criterion for a morphological diagnosis of PI.

From all 308 investigated babies 157 (50.9%) were with PI. PI has certain correlation to the degree of immaturity of the foetuses as a whole, which

is absolutely reasonable; however, not every baby with lower weight of birth had PI. Therefore, the terms "immaturity" and "born-out-of-terminal-pregnancy" must not equalize.

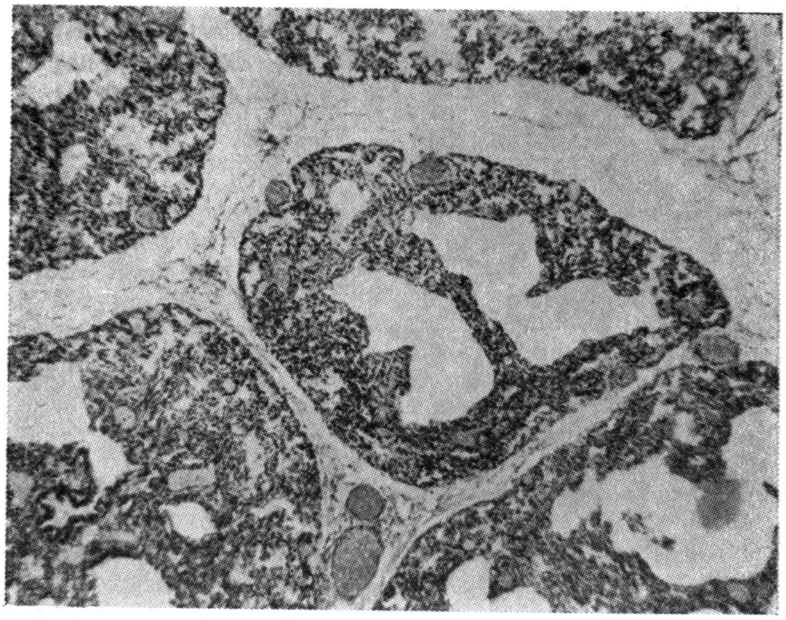

Fig. 2

Most often pathological processes established in the lungs of new-borns with PI are studied. There is a statistically reliable difference between the frequency of pulmonary pathological processes of babies with PI and without PI: 33.7% compared to 1.3%. This is very important index showing the significance of PI for pulmonary disorders.

Next coming frequent pathological process in lungs of immature-born babies was pulmonary diffusive atelectasis. It was established in 24 objects (15.23%) compared to only 2.65% in the lungs of normally born foetuses.

Certain interest required those babies whose lungs did not show heavy structural changes, but with clinical and morphological features of asphyxia. Together with PI it was established a haemorrhagic-oedematic syndrome and small-sized located atelectasis of the lungs. Such characteristics of pulmonary disorders were established in 24 (15.23%) babies with immature lungs. Similar changes in normally born foetuses were nor detected.

Massive pulmonary haemorrhages were found out in 10.83% of autopsized objects with PI; this finding could not be contributed to any other pathological disorder.

The suggested morphological criteria, simple and easy for the everyday practice of the pathologists, are rather actual and punctual for the diagnosis of PI. Our study proves the undoubtful role of PI for the development and character of pneumopathies of new-borns. The fact that the percent of PI among the autopsy material (still-born and new-born) is 50.9% proves the import

ance of the studied pathological process for the respiratory disorders of the babies. It is a pity, that there were no data in the available literature, showing the frequency of PI according to the variety of the sectional material and due to that we were not able to compare our results to any other. Some authors (19) presume that all lungs at the time of birth have more or less features of PI and their maturity comes not before the 21-st day of life. This is something which can not be accepted without any reserves because it was established only by investigation of rats. Besides that we could establish PI in children after their 20-day age.

Our study confirms the results of some other authors (10) that the immature lung has smaller quantity of functional parenchyme when compared to the interstitial component and: the more mature the lung is, the more often the relation between stroma and airy spaces is changed for the account of latter. The functional insufficiency of immature lung is connected with the more expressed resistance of the pulmonary tracts of mature babies and adults (7, 11, 12, 14).

Certain interest require also those children died of asphyxia where we detected located atelectasis and haemorrhagic-oedematic syndrome. The base of asphyxia in all these cases is the functional insufficiency of immature lung. Therefore, we suggest that it would be more proper to use the diagnosis "pulmonary immaturity" as the initial disease and separated nosological unit. It would not be the same if we put a diagnosis "asphyxia" because by using this term we show only the lethal mechanism, but not the cause for that. Gruenwald explains the respiratory disorder in such cases with unsufficient stability of pulmonary spreading. The immature lung, due to unsufficient synthesis of surfactant, is not able to keep the air of the first breathing and as a result of it the organ collapses and every second take of breath is heavier and heavier.

1. The studied by us morphological features are actual for the diagnosis of PI with necropsy materials and can be applied in the everyday practice of all pathologists.

2. The knowledge of all morphological peculiarities of PI and the pathological processes coming out of it provide a possibility for a detailed study of the pulmonary pathology in perinatal period.

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ГИСТОЛОГИЧЕСКИЕ И МИКРОМЕТРИЧЕСКИЕ КРИТЕРИИ ЛЕГОЧНОЙ НЕЗРЕЛОСТИ И ИХ ЗНАЧЕНИЕ ПРИ ИССЛЕДОВАНИИ ПЕРИНАТАЛЪНОЙ ПАТОЛОГИИ

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РЕЗЮМЕ

На основании гистологических и микрометрических исследовании некропсического материала из легких умерших новорожденных и мертворожденных детей устанавливаются критерии легочной незрелости. Наиболее существенными морфологическими признаками легочной незрелости являются малые размеры альвеол, высокий альвеолярный эпителий, утолщенные стенки альвеол, обилие интерстициальной составной части легких. С возрастом и по мере созревания легких соотношение между воздушными пространствами и интерстицием изменяется за счет воздушных пространств. Делается вывод, что значение морфологических критериев легочной незрелости и связанных с нею патологических процессов дает возможность правильно оценивать легочною патологию новорожденных.